

← Eight of the C sh bz kernels were Wx. None of these, however, showed any Wx to wx variegation. In order to rapidly visualize the types and frequencies of chromosomes 9 constitutions that the gametes of this plant could have, a diagram of the usual synaptic association of the two chromosomes 9 in this plant and the resulting types of cross-over chromatids, is included with table 14-a. It may be seen from this diagram that the 8 C sh bz Wx kernels could arise from crossing over in the region of the arrow--between the distal Wx locus and the point that marks the beginning of the proximal duplicated segment. These chromosomes--carrying C sh bz Wx--should be normal in morphology and should have no Ds locus. Therefore, no Wx - wx variegation should appear in the kernels receiving such a chromosome. As stated above, no Wx - wx variegation appeared in the C sh bz Wx kernels.

This same plant was crossed to an ac ac female plant having the rearranged chromosome 9 with c Sh Bz wx ds and a normal chromosome 9 with C sh bz wx ds (table 14-b). In this cross, the 65 C - c, Sh Bz Wx - wx kernels arose from fusion of a female nucleus carrying the c Sh Bz wx chromosome with a male nucleus carrying the Duplication chromosome. In the resulting variegated kernels, all the c areas were wx. No extensive wx sectors regularly appeared in the C areas. Again this shows that the Ds locus in the Duplication chromosome 9 of the male parent must be to the right of the Wx loci.

With regard to chromosomes 9, plant 4628K-2 had the same genic and chromosomal constitution as plant K-1. It was, however, ac ac. When crossed to C sh bz wx ds ac female plants (table 15-a) or to c sh Bz wx ds ac female plants (table 15-b), no variegated kernels appeared. There were only three types of kernels on the ear in each of these two crosses. On the basis of the given constitution of

Table 15-a

C sh bz wx ds ac ♀ x C ds sh bz Wx Bz Sh Ds (Dup.) ac ac ♂
 C ds sh bz wx (normal)

4628K-2

Cross	♂ Duplication chromosome 9	♂ normal chromosome 9	
	C Sh Bz Wx non-variegated	C sh bz Wx	C sh bz wx
4361-11 x 4628K-2	124	4	132

Crossovers in sh class: 3- $\frac{1}{2}$

Table 15-b

c sh Bz wx ds ac 9 x 4628K-2

Cross	Duplication chromosome 9	Normal chromosome 9	
	C Sh Bz Wx	C sh Bz Wx	C sh Bz wx
4347-6 x 4628K-2	167	3	214

Crossovers in sh class: 1.4%

Table 15-c

C sh bz wx ds, Ac ac ♀ x 4628K-2 ♂

Cross	Duplication chromosome 9		Normal chromosome 9	
	C Sh Bz Wx non-varie- gated	C Bz-C bz, Sh-sh, Wx-wx	C sh bz Wx Non-varie- gated	C sh bz wx
4462C-2 x 4628K-2	70	65	15	213

Crossovers in sh class: 5.7%

plant 4628K-2, only three types of kernels are to be expected. The C sh Wx kernels, in both tables, should have a normal chromosome 9 carrying C sh bz Wx that arose from a crossover in the region between the distal Wx locus and the position that marks the beginning of the proximal duplicated segment. This crossover distance is 3% and 1.4% of the C sh kernels in tables 15-a and 15-b, respectively, and is similar to that observed for the same region in plant 4628K-1.

When plant 4628K-2 was crossed to a C sh bz wx ds, Ac ac female plant (table 15-c) approximately half of the kernels receiving a chromosome 9 carrying C Sh Bz Wx were C Bz - C bz, Sh - sh, Wx - wx variegated. There were 13 C sh bz Wx kernels (5.7% of the C sh bz class) and again none of these 13 kernels showed any Wx to wx variegation. As explained above, variegation is not expected in these kernels.

Plant 4628K-2 was crossed to an Ac ac plant carrying c Sh Bz Wx Ds in a normal chromosome 9 and c sh Bz wx ds in a rearranged chromosome 9 (table 15-d). The appearance of the 79 C - c variegated kernels in the Sh Wx class is expected from the given constitution of this plant. (Segregation of these 79 C-c kernels into the 2 classes, Sh Wx and Sh-sh, Wx-wx, has not been indicated in the table.) These C-c kernels have Ac Ac ac constitution. The Ds mutations occur late in development, as might be expected.

(h). Sub-culture L

Plant 4628L-1, which arose from a C Sh Bz Wx kernel of table 3, carried C ds Sh Bz Wx Wx Bz Sh Ds² in a Duplication chromosome 9 and C ds sh bz wx ds in a normal chromosome 9. Two allelic Ac loci were present (Ac Ac). This plant was crossed to a C sh bz wx ds ac female

Table 15-d

c, sh Bz wx ds

Ac ac ♀ x 4628K-2 ♂

c Sh Bz Wx Ds

4435-1

Cross	C Sh Wx non-varie- gated	C-c, Sh(-sh)*, Wx(-wx)	C sh wx and C sh wx non-varie- gated
4435-1 x 4628K-2	220	79	137

* Some kernels are Sh-sh and Wx-wx variegated; others are not, as expected from constitution of ♀.

plant (table 16-a) and to three c sh Bz wx ds ac female plants (table 16-b). The types of kernels appearing on the ears of these test crosses have made it possible to write the genic constitution of the chromosomes 9 in this plant. Crossing over between the normal chromosome 9 and the Duplication chromosome 9 in the region of the distal duplicated segment occurred frequently and was normal in relative frequencies between the marked loci. The percentages in the marked regions are given in tables 16-a and 16-b. The explanatory supplement accompanying each of these tables will make this evident.

No Wx - wx variegation or extensive wx sectors regularly appeared in the C Bz areas of the variegated kernels of table 16-a. All of the C bz areas were wx; none showed Wx - wx variegation. In the cross to the c sh Bz wx ds ac female plants, the Ds mutation in the C Sh Wx kernels resulted in c sh wx sectors. No Wx - wx variegation was present in the C areas and, as stated, all the c areas were wx. Again, large wx sectors were not appearing in the C areas. This type of variegation would be expected if only one Ds locus were present and if its position were to the right of the proximal duplicated segment. It should be noted that none of the C Sh bz wx or C Sh Bz wx kernels in table 16-a was C - c variegated. None should be variegated for these kernels should have a normal chromosome 9 with no Ds locus. These C Sh bz wx and C Sh Bz wx chromosomes arose from a crossover in regions 1 and 2, respectively. It should be noted that no C sh bz Wx kernels were produced. These would appear only if a pollen grain carried a double cross-over chromatid (regions 2 and 3). Such a double cross-over chromatid should appear relatively infrequently. No such chromatid was represented on this ear.

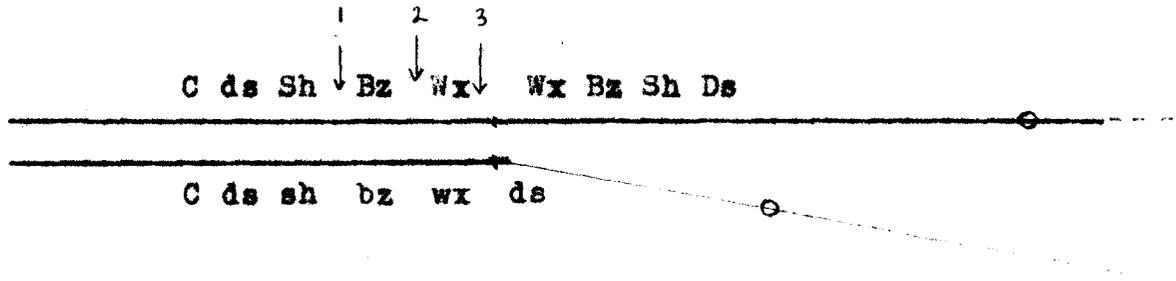
Table 16-a

C sh bz wx ds ac ♀ x $\frac{C ds Sh Bz Wx Wx Bz Sh Ds^2}{C ds sh bz wx ds}$, Ac Ac ♂
 4363-3 4628L-1

C Sh Bz Wx	C Bz-C bz, Sh-sh, Wx-wx	C Sh Bz wx non-variegated	C Sh bz wx	C sh bz Wx	C sh bz wx
13*	125	74	10	0	128

* Several have a few wx spots.

Supplement to table 16-a



Non-crossovers	C ds Sh Bz Wx Wx Bz Sh Ds	= C Bz-C bz, Sh, Wx-wx	
	C ds sh bz wx ds	= C sh bz wx	128
Region 1	C ds sh Bz Wx Wx Bz Sh Ds	= C Bz-C bz, Sh, Wx-wx	
	C ds Sh bz wx	= C Sh bz wx	10
Region 2	C ds sh bz Wx Wx Bz Sh Ds	= C Bz-C bz, Sh, Wx-wx	
	C ds Sh Bz wx ds	= C Sh Bz wx	74
Region 3	C ds sh bz wx Wx Bz Sh Ds	= C Bz-C bz, Sh, Wx-wx	
	C ds Sh Bz Wx ds	= C Sh Bz Wx	13*

Summary:

Crossing over Region 1 - 4.4%
 Region 2 - 32.8%
 Region 3 - 5.7%

* Too high; probably includes some No Ds or No Ac gametes due to loss or transposition of Ds or Ac.

Table 16-b

^{B₂}
c sh wx ds ac 9 x 4628L-1 ♂

Cross	C Sh Wx non-varie- gated	C-c, Sh-sh, Wx-wx	C Sh wx	C sh Wx	C sh wx	Odds
4347-4 x 4628L-1	10	129	68	2	117	*
4418F-2 x 4628L-1	8	50	36	1	52	1 colorless Wx-wx;Sh
4418F-2 x 4628L-1	4	39	46	0	73	
Totals	22	218	150	3*	242	

* 1 has defective embryo; probably carries an abnormal chromosome 9.

* See test of this kernel in summer of 1949; culture 4895
Resulted from contamination - Here I sh wx D₁A / c sh wx ac

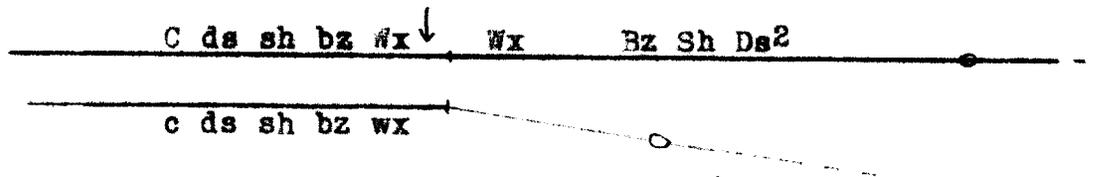
Table 17a

C sh bz wx ds ac ♀ x C ds sh bz Wx Wx Bz Sh Ds² Ac ac ♂
 C ds sh bz wx ds

4628L-2

Cross	C Sh Bz Wx non-variegated (ac ac ao)	C Bz-C bz, Sh-sh, Wx-wx (Ac ac ac)	C sh bz Wx non variegated (Ac ac ac and ac ac ac)	C sh bz wx (Ac ac ac and ac ac ac)
4361-16 x 4628L-2	59	59	11	255
4366-9 x 4628L-2	37	34	11	245
Totals	96	93	22	500

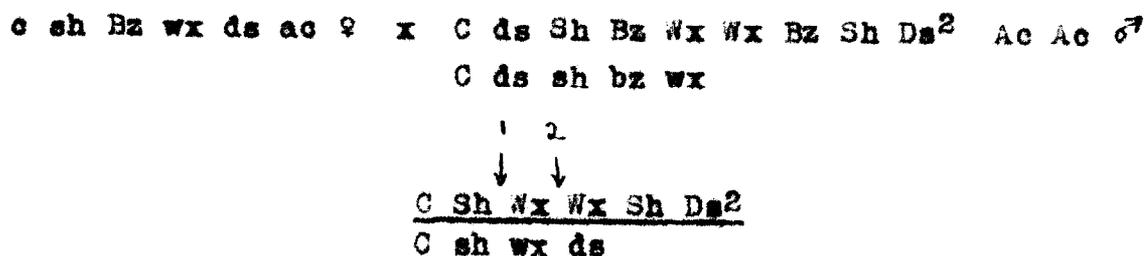
Cross-over region



Cross-overs: C ds sh bz wx Wx Wx Bz Sh Ds² Duplication chromosome 9
 C ds sh bz wx ds Normal chromosome 9 = 22

Normal chromosome class : 522
 Crossovers : 4.2%

Supplement to table 16-b



Non-crossovers	C Sh Wx Wx Sh Ds ²	- C-c, Sh-sh, Wx-wx	
	C sh wx ds	- C sh wx	242
Region 1	C sh Wx Wx Sh Ds ²	- C-c, Sh-sh, Wx-wx	
	C Sh wx ds	- C Sh wx	150
Region 2	C sh wx Wx Sh Ds ²	- C-c, Sh-sh, Wx-wx	
	C Sh Wx ds	- C Sh Wx	22*
Regions 1 & 2	C Sh wx Wx Sh Ds ²	- C-c, Sh-sh, Wx-wx	
	C sh Wx ds	- C sh Wx	3

* Too high; probably includes No Ds, or No Ac ♂ gametes due to loss or transposition of Ds or Ac.

Summary of crossing over: Region 1 : 36.7%
 Region 2 : 6%
 Doubles : 0.72% (with no interference would expect 2.27%)

Plant 4628L-2 was similar to plants 4628K-1 and K-2 in the genic and chromosomal constitutions of its chromosomes 9. It was heterozygous for Ac (Ac ac). In crosses to C sh bz wx ds ac female plants, half of the C Sh Bz Wx carrying kernels were C Bz - C bz, Sh - sh, Wx - wx variegated (the Ac ac ac kernels) and half were non-variegated (the ac ac ac kernels), table 17-a. Again, in this cross, a small percentage of the C sh bz kernels were Wx (4.2%) and again, none of these kernels were Wx - wx variegated. The reason for this has been stated previously in the description of similar crosses involving 4628K-1 and K-2.

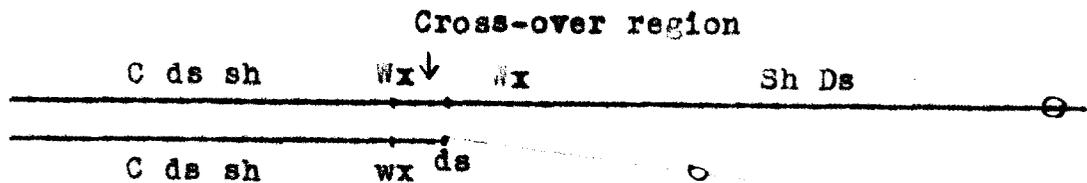
When plant 4628L-2 was crossed to a c sh Bz wx ds ac female plant, the expected types of kernels appeared, table 17-b. Half of the C Sh Wx kernels were non-variegated and half were C - c, Sh - sh, Wx - wx variegated. In the variegated kernels, all c areas were wx and no large wx sectors were regularly appearing in the C areas. The 13 C sh Wx kernels (3.9% of the sh class) were non-variegated. To repeat, since they carry a normal chromosome 9 with no Ds locus, no variegation should appear.

Plant 4628L-2 was crossed to a c sh Wx, Ac Ac female plant. The kernels resulting from this cross are indicated in table 17-c. No obvious C - c variegation could be observed in approximately half of the C Sh kernels. These are probably the Ac Ac Ac kernels. The kernels showing C - c variegation had a pattern of Ds mutations characteristic of Ac Ac ac constitutions. Again, it may be noted that no C - c variegation was present in the C sh class of kernels. No variegation is expected.

Table 17 b

c sh wx ds ac ♀ x 4628L-2 ♂

Cross	C Sh Wx non-varie- gated	C-c, Sh-sh, Wx-wx	C sh Wx non-varie- gated	C sh wx
	Ac	Ac	Ac and ac	Ac and ac
4347-24 x 4628L-2	39	35	13	317



Cross-over:

Duplication chromosome 9

C ds sh wx Wx Sh Ds

Normal chromosome 9

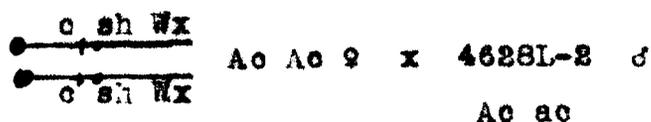
C ds sh Wx - 13

Total kernels = 404

Normal chromosome class : 330

crossovers : 3.9%

Table 17-c



Cross	Duplication chromosome from ♂		Normal chromosome from ♂
	C Sh Wx Not obviously variegated (Ac Ac Ac)	C-c, Sh-sh, Wx (Ac Ac ac)	C sh Wx non-variegated (Ac Ac Ac and Ac Ac ac)
4355-20 x 4628L-2	65	59*	219

* 58 kernels are speckled with c; late Ds mutation

1 Kernel has an Ac ac ac type of C — c variegation. See Report on
Ac inheritance for explanation.

Table 18

Plants arising from various kernels ^{on} ~~from~~ self-pollination^{ed} of plant 4506 (see Table 3).
 Chromosomal and genic constitutions of plants of culture 4628; sub-cultures C to L.
 Dup. - Duplication chromosome 9. Nor. - Normal chromosome 9

Plant	Chromosome 9 constitution	Activator constitution	Table or page reference	Appearance of kernel from which plant arose
4628C-9	Dup. I Ds ¹ Sh Bz Wx Wx Bz Sh Ds ² Dup. I Ds ¹ Sh Bz Wx Wx Bz Sh Ds ²	Ac Ac	Table 7	I Sh Wx
" D-10	Dup. I Ds ¹ Sh Bz Wx Wx Bz Sh Ds ² Nor. C ds sh bz wx ds	Ac ac	Table 8	I-C Bz-C bz, Sh-sh, Wx-wx
" D-11	Dup. I Ds ¹ Sh Bz Wx Wx Bz Sh Ds ² Nor. C ds sh bz wx ds	Ac ac	Table 8	I-C Bz-C bz, Sh-sh, Wx-wx
" F- 1	Nor. I Ds ¹ Sh Bz wx ds Nor. C Ds sh bz wx ds	Ac Ac	Table 9	I Sh wx
" F- 2	Nor. I ds ¹ Sh Bz wx ds Nor. C ds sh bz wx ds	?	Table 10 (see page 15)	I Sh wx
" G- 1	Nor. I Ds ¹ Sh Bz wx ds Nor. C ds sh bz wx ds	Ac ac	Table 11	I-C Bz-C bz, Sh-sh, wx
" G- 2	Nor. I Ds ¹ Sh Bz wx ds Nor. C ds Sh bz wx ds	Ac ac	Table 11	I-C Bz-C bz, Sh-sh, wx
" G- 3	Nor. I Ds ¹ Sh Bz wx ds Nor. C ds sh bz wx ds	Ac ac	Table 11	I-C Bz-C bz, Sh-sh, wx

Table 18 continued

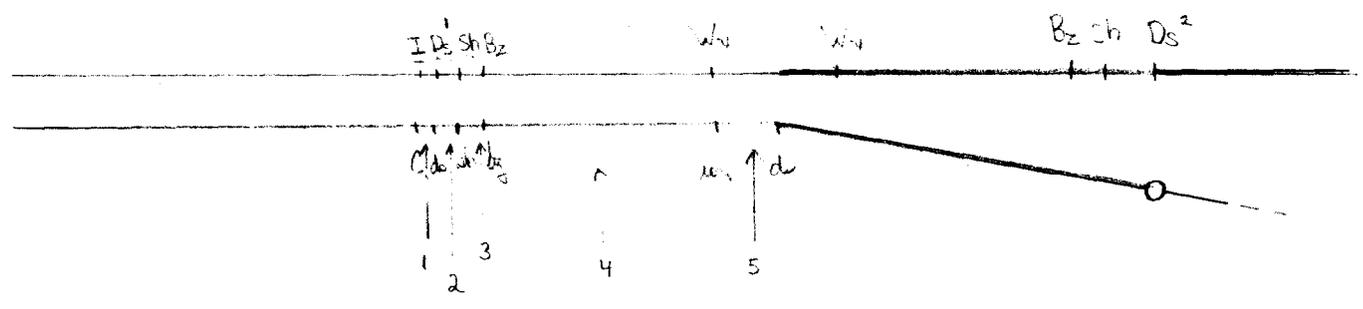
4628H-1	Nor. I Ds ¹ Sh Bz wx Nor. C ds sh bz wx	Ac ac	Table 12	I-C Bz-C bz, Sh-sh, wx
" H-2	(Nor. I Ds ¹ Sh Bz wx Nor. C ds sh bz wx)	Ac ac	See page 18	I-C Bz-C bz, Sh-sh, wx
" I-1	Nor. C sh bz wx Heterofertilization Nor. C sh bz wx	Not tested	See page 18	I sh wx
" I-2	Nor. I Ds ¹ sh bz wx ds Nor. C ds sh bz wx ds	ac ac	Table 13	I sh wx
" K-1	Dup. C ds sh bz Wx Wx Bz Sh Ds ² Nor. C ds sh bz wx ds	Ac Ac	Table 14	C Sh Bz Wx
" K-2	Dup. C ds sh bz Wx Wx Bz Sh Ds ² Nor. C ds sh bz wx ds	ac ac	Table 15	C Sh Bz Wx
" L-1	Dup. C ds Sh Bz Wx Wx Bz Sh Ds ² Nor. C ds sh bz wx ds	Ac Ac	Table 16	C Bz-C bz, Sh-sh, Wx-wx
" L-2	Dup. C ds sh bz Wx Wx Bz Sh Ds ² Nor. C ds sh bz wx ds	Ac ac	Table 17	C Bz-C bz, Sh-sh, Wx-wx

5. Consideration of the events responsible for the transposition of the Ds locus

The genetic analyses of the plants in culture 4628 has allowed a reconstruction to be made of the genic and morphological constitution of the chromosome 9 in the mother plant (4306). All the tested plants, except 4628C-9, had one normal chromosome 9 carrying C sh bz wx. The constitution of the homologous chromosome 9 in some of the sub-cultures (D, E, G and H) could be anticipated from the type of variegation appearing on the kernels from which these plants arose. The constitutions of plants in sub-cultures F and I could likewise be anticipated within the scope of several simple alternatives. The plants in sub-cultures K and L could have a number of different chromosomal and genic constitutions. To determine the exact constitutions of each plant would require the tests that have been described above.

Figure 1 has been constructed to make this anticipation readily appreciated. Sub-cultures D and E probably received a non-crossover Duplication chromosome 9. Plant 4628I-2 and L-1 received chromosomes arising from a crossover in region 2 in the mother plant. The crossover chromatid in 4628I-2 is the reciprocal of the one present in 4628L-1. Region 4 has the longest unit crossover distance. A crossover in this region would give rise to a morphologically normal chromosome 9 with I Ds¹ Sh Bz wx and a Duplication chromosome 9 with C ds sh bz Wx Wx Bz Sh Ds². These two classes of reciprocal crossover chromatids should be the most frequent of all of the crossover classes of chromatids and therefore they should be the most frequent ones recovered in a self-pollination or an outcross. Although the numbers are few, the analysis of the genic constitutions of the chromosomes 9 in the plants in sub-cultures F, G and H and in sub-cultures K and L are in agreement with this expectation.

Figure 1

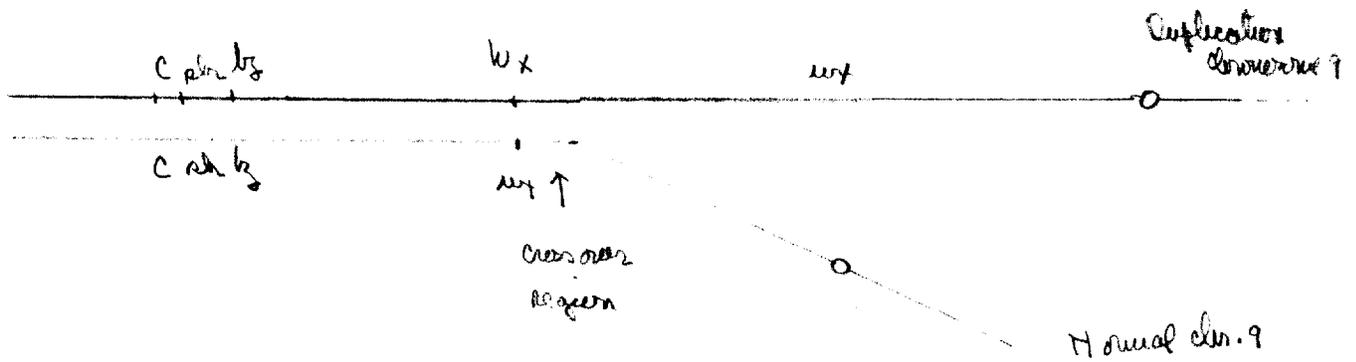


Cross-over chromatids recovered from plant 4306.

- Region 2
 I Ds¹ sh bz wx; Normal chromosome 9; Plant 4628I-2
 C ds Sh Bz Wx Wx Sh Ds²; Duplication chromosome 9; Plant 4628L-1
- Region 4
 I Ds¹ Sh Bz wx; Normal chromosome 9; Plants 4628F-1, G-1, G-2, G-3, H-1, H-2
 I ds sh bz Wx Wx Bz Sh Ds²; Duplication chromosome 9, Plants 4628K-1, K-2, L-2.

The order of the genes in the proximal segment has been given little consideration in the preceding discussion. It is necessary to indicate, therefore, why this order is required and why the particular marked loci have been placed in this segment. The analysis of the synaptic configurations of a normal chromosome 9 and the Duplication chromosome 9 in the heterozygous plants (pages) and the analyses of the chromosomal and genic constitutions of the recovered crossover chromatids along with their frequencies, has indicated the composition and order of genes in the distal of the two duplicated segments. It is composed of a unit of the normal short arm of chromosome 9 that begins just to the right of the I locus and extends to a locus approximately 4 units to the right of *wx*. It is present in the Duplication chromosome 9 in the normal order, as these studies have shown. A *Ds* locus is present at the junction of this unit with the distal third of the short arm. In other words, the Duplication chromosome 9 has a normal genic and chromosomal composition from the end of the short arm to a position approximately 4 crossover units beyond *wx* with the exception, however, that a *Ds* locus is present just to the right of the I locus.

The proximal duplicated segment must contain *Sh*, *Bz* and *wx*. The presence of *wx* in this segment is indicated by the crosses of 4628K-1, K-2 and L-2 to C *sh bz wx* female plants. If no *wx* locus were present in this segment or if *wx* were present, one should obtain some C *Sh Bz wx* kernels and those having *Ac* should be C *Bz - C bz* variegated. They should appear in approximately 4% of the C *Sh Bz* class for they would be the reciprocals of the C *sh bz wx* kernels:



Such kernels would not appear, however, if a *Wx* locus were carried by the proximal duplicated segment. Such kernels did not appear in the crosses. It could be concluded, therefore, that a *Wx* locus must be present in this segment.

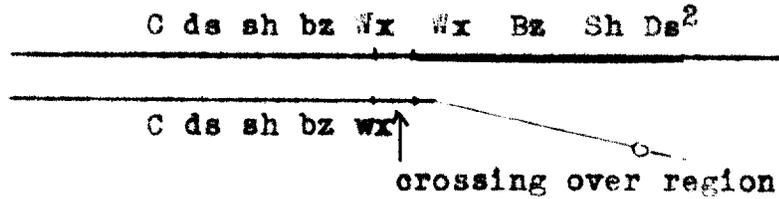
Sh and *Bz* loci must likewise be present in this segment. The evidence for this is apparent from several considerations. It is most obvious, of course, in the phenotypes produced by the Duplication chromosome 9 in plants 4628K-1, K-2 and L-2. It is the *Sh* and *Bz* loci in this proximal segment that accounts for the *Sh* and *Bz* phenotypes that appear in the kernels from which each of these plants arose and in the kernels having the Duplication chromosome 9 in crosses of these plants to *sh bz* plants.

Neither *I* nor *C* can be present in the proximal duplicated segment. The absence of a *C* locus in this segment was considered on page 9. The absence of an *I* locus in this segment is apparent from the phenotypes that result from a Ds^1 mutation in an $I Ds^1 Sh Bz Wx Wx Sh Bz Ds^2 / C sh bz wx / C sh bz wx, Ac ac ac$ kernel. A Ds^1 mutation deletes the *I* locus distal to Ds^1 . The resulting phenotype is *C*. Again, if *I* were present in this segment a Duplication chromosome 9 with the constitutions shown to be present in sub-cultures 4628 K and L would not be recovered. These chromosomes have no *I* locus in the proximal segment. Neither an *I* locus, nor a *C* locus, therefore, is present in the proximal segment.

All of these considerations point towards the exact composition of the two segments with regard to the loci they carry. The position of breakage that could give rise to such segments is also indicated. The distal segment extends from a position just to the right of I (demarcated by the inserted Ds^1 locus) to a position 3 or 4 crossover units to the right of the Wx locus in this segment. Crossing over between a normal chromosome 9 and the Duplication chromosome 9 is normal in kind and relative frequency within this distal segment, as the tables have shown. The crossover unit distance between this distal Wx locus and the junction with the proximal segment in the plants heterozygous for the Duplication chromosome 9 is the same as the crossover unit distance between Wx and Ds -standard in plants with two normal chromosomes 9. A summary of the cross over percentages in this region, that occurred in plants 4628K-1, K-2 and L-2 where it could be determined, is given in table 19. The junction of the two segments is marked by the position that Ds -standard occupies in a normal I Sh Bz Wx Ds chromosome. As shown in tables 1 and 2, the chromosome 9 in plant 4108C-1 that carried I Sh Bz Wx and Ds , was normal in its genetic behavior and had Ds at the standard location. The presence of only two recognizable odd gametes was observed in the crosses of this plant. One of these had the duplication that arose from an aberration occurring within this I Sh Bz Wx Ds chromosome. In this Duplication chromosome 9, the proximal segment has the same genes within it as the distal segment. This indicates that chromosome breakage occurred in a cell of the parent plant (4108C-1) at the Ds locus and also at a position just to the right of the I locus. This was followed by fusions of broken ends that at the same time included a transposition of a Ds locus between two of these ends. Before this event may be reconstructed,

Table 19

Summary of table of percent crossing over between the distal Wx locus and the end of the distal duplicated segment based on the recovered normal chromosomes 9 in crosses of plants 4628K-1, 4628K-2 and 4628L-2



Cross	C sh wx	C sh Wx	Percent crossing over
4362C-3 x 4628K-1	323	8	2.4
4365-1 x 4628K-1	150	1	0.66
4361-11 x 4628K-2	132	4	2.9
4347-6 x 4628K-2	214	3	1.4
4462C-2 x 4628K-2	213	13	5.7
4361-16 x 4628L-2	255	11	4.1
4366-9 x 4628L-2	245	11	4.3
4347-24 x 4628L-2	317	13	3.9
Totals	1849	64	3.3

Total kernels: 1913

it is necessary to inquire into the order of the genes in the proximal segment.

The order of genes in the proximal segment has been determined from two general types of evidence: first, the type of variegation patterns in the kernels having the Duplication chromosome 9 and secondly, the types of chromatids that plants heterozygous for the Duplication have produced. The order could be (1) I Ds¹ Sh Bz Wx Sh Bz Wx Ds² or (2) I Ds¹ Sh Bz Wx Wx Bz Sh Ds². If (1) were correct, it would be difficult to explain how the large wx areas could arise that frequently appear in the C Bz sectors in the I - C Bz - C bz, Sh - sh, Wx - wx variegated kernels of tables 7-a and 8. If the second of the two genic orders was present, just such wx regions should appear because the breakage-fusion-bridge cycles that are initiated by Ds¹ mutations should often result in deletions of the two Wx loci from some cells while retaining the proximal Bz locus. In the crosses indicated, the resulting cells would be C Bz wx. If order (1) were present, the C Bz sectors that are variegated should have some C bz areas within them that are Wx - wx variegated. As stated earlier, no such C bz areas are present. All of the C bz areas are wx. If order (2) were present, all the C bz areas within the C Bz sectors should be wx for the Wx loci should be lost from some cells by the breakage-fusion-bridge mechanism before the proximal Bz locus is lost. In other words, Bz will not be lost before the Wx loci are lost. In the crosses of plants 4628 K-1, K-2 and L-2 to C sh bz wx plants, no large wx areas appeared in the C Bz sectors of the variegated kernels and none are expected as there is no Ds locus to the left of Ds² that, by mutation, could initiate a dicentric chromatid having Bz and Wx in the region between the two centromeres. These several observations, then, strongly support the given inverted order of the genes in the proximal segment.

Figure 2

Types of chromatids that should be produced by crossing over with order of genes (1) and (2) in Duplication chromosome 9

Type (1) order

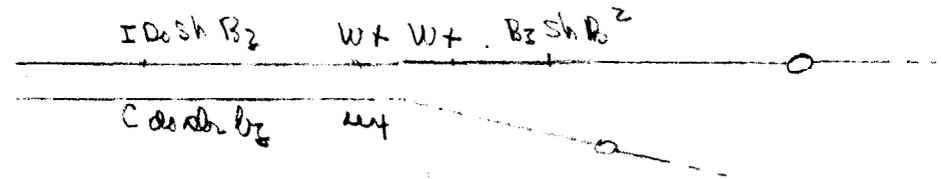
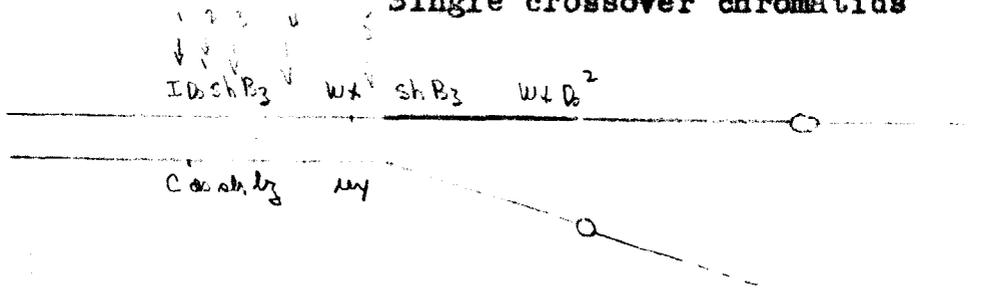
Type (2) order

A. Synapsis of distal segment of Duplication chromosome 9 with homologous segment in the normal chromosome 9

A. Synapsis of distal segment of Duplication chromosome 9 with homologous segment in normal chromosome 9

Single crossover chromatids

Single crossover chromatids



Region 1

Region 1

I ds sh bz wx ds Normal chromosome

I ds sh bz wx ds Normal chromosome

C Ds¹ Sh Bz Wx Sh Bz Wx Ds² Duplication chromosome

C Ds¹ Sh Bz Wx Wx Bz Sh Ds² Duplication chromosome

Figure 2 continued

Region 2

I Ds¹ sh bz wx ds Normal chromosome
 C ds Sh Bz Wx Sh Bz Wx Ds² Duplication
 chromosome

Region 3

I Ds¹ Sh bz wx ds Normal chromosome
 C ds sh Bz Wx Sh Bz Wx Ds² Duplication
 chromosome

Region 4

I Ds¹ Sh Bz wx ds Normal chromosome
 C ds sh bz Wx Sh Bz Wx Ds² Duplication
 chromosome

Region 5

I Ds¹ Sh Bz Wx ds Normal chromosome
 C ds sh bz wx Sh Bz Wx Ds² Duplication
 chromosome

Region 2

I Ds¹ sh bz wx ds Normal chromosome
 C ds Sh Bz Wx Wx Bz Sh Ds² Duplication
 chromosome

Region 3

I Ds¹ Sh bz wx ds Normal chromosome
 C ds sh Bz Wx Wx Bz Sh Ds² Duplication
 chromosome

Region 4

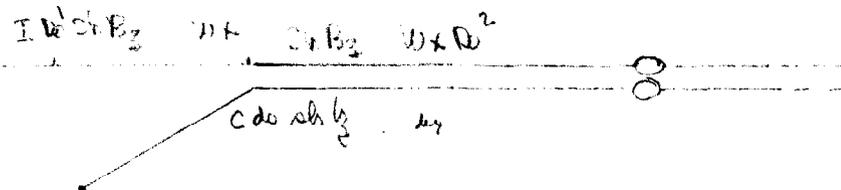
I Ds¹ Sh Bz wx ds Normal chromosome
 C ds sh bz Wx Wx Bz Sh Ds² Duplication
 chromosome

Region 5

I Ds¹ Sh Bz Wx ds Normal chromosome
 C ds sh bz wx Wx Bz Sh Ds² Duplication
 chromosome

Figure 2 continued

B. Synapsis of proximal segment of Duplication chromosome 9 with homologous segment in Normal chromosome 9



Single crossovers

Region 1

I Ds¹ Sh Bz Wx sh bz wx ds Duplication chromosome

C ds Sh Bz Wx Ds² Normal chromosome

Region 2

I Ds¹ Sh Bz Wx Sh bz wx ds Duplication chromosome

C ds sh Bz Wx Ds² Normal chromosome

Region 3

I Ds¹ Sh Bz Wx Sh Bz wx ds Duplication chromosome

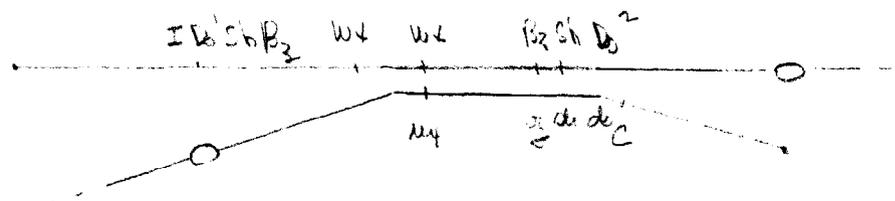
C ds sh bz Wx Ds² Normal chromosome

Region 4

I Ds¹ Sh Bz Wx Sh Bz Wx ds Duplication chromosome

C ds sh bz wx Ds² Normal chromosome

B. Segment of proximal segment of Duplication chromosome 9 with homologous segment in Normal chromosome 9



All single crossovers would give a dicentric chromosome and an acentric fragment. The dicentric chromosome would be deficient for the terminal third of the short arm.